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PURE STRAINS AS ARTIFACTS OF BREEDING

Students of the minute anatomy of plant or animal tissues are on their guard against artifacts. Chemical reagents often contract or coagulate the protoplasm or cause the precipitation of granules or crystals. The artificial results of the methods of preparation have to be distinguished from the normal structures of the protoplasm. Precautions are equally necessary in the study of evolution and heredity, to avoid mistaking artificial products of breeding for typical conditions.

Close-bred, uniform groups of plants and animals form the basis of the idea of "pure strains," "elementary species" or "biotypes." If the descendants of the same parents appear sufficiently alike the strains are said to be "pure." General inferences regarding heredity and evolution are being based on the assumption that this uniform "purity" represents a natural condition. Yet there can be no doubt that the methods used in maintaining and testing the purity of strains are calculated to produce an artificial uniformity of characters, commonly accepted as the proof of purity.

If the habits of a plant will permit, the readiest method of securing uniform progeny is by vegetative propagation. Nevertheless, the idea of pure strains is not usually connected with vegetative varieties, for it is recognized that uniformity lasts only while vegetative propagation is continued. As soon as seeds and seedlings are grown the natural individual diversity reappears. The vegetative propagation only conceals the inherent diversity by devices that avoid the production of seedlings.

The uniformity of groups of seedling plants is of the same artificial nature as the uniformity of vegetative varieties. Particular methods of reproduction are necessary to secure uniform seedlings—methods which may not be essentially different from those represented by cuttings or offshoots. Plants grown from buds or cuttings have only one parent, and the same is true of seedlings produced by self-fertilization. It is only when conjugation is restricted to cells of the same individual or of closely related individuals that uniform seedlings are obtained. The external formalities of conjugation are preserved, but without the essential diversity of descent which gives conjugation a physiological significance.

The uniformity of varieties of wheat and other strictly self-fertilized plants depends as closely upon self-fertilization as

the uniformity of vegetative strains upon vegetative propagation. As soon as individual wheat plants are crossed, even inside the same variety, a wide range of diversity reappears. Self-fertilization, like vegetative propagation, brings uniformity by suppressing the inherent tendencies to diversity. Pure strains continue to seem pure as long as only one set of characters is brought into expression, but the latent diversities do not cease to be transmitted, and at once reappear when hybrids are made, or selection is relaxed, or the plants are transferred to new conditions.

It is true that uniformity like that of the pure strains of domesticated varieties is sometimes found in nature, but even this does not prove that uniformity represents a truly normal condition of reproduction. Having learned that artificially restricted descent produces uniformity in domesticated varieties, it is easy to understand that natural conditions of close breeding can also produce uniformity.

The methods of reproduction that yield uniform offspring often appear very effective from the environmental standpoint, but this only shows the more plainly their physiological inferiority. All indications point to the probability that long-continued vegetative propagation, self-fertilization or close breeding bring the same deterioration, sterility and ultimate extinction to wild types as to domesticated varieties. It does not appear that the vigor and fertility of organisms can be permanently maintained by the methods of reproduction required for pure strains. Free interbreeding among diverse individuals to form a continuous network of descent is the natural relation of the members of species.

The physiological inferiority of pure strains forbids our acceptance of theories of evolution and heredity based upon the idea of uniformity. Neither uniformity itself nor the attendant phenomena of mutation and Mendelism represent primary biological facts, typical of organic existence and evolutionary progress. The restriction of descent to closely similar and closely related individuals is a change from a natural state to a relatively artificial, atypical condition. Darwin saw in the facts of Mendelian inheritance a definite evidence of the abnormality of mutations, but the significance of this relation is not fully appreciated until we perceive that the uniformity of pure strains already marks a first step toward degeneration.

WASHINGTON, D. C.,
February 10, 1909.

O. F. COOK.